WILDLIFE CONSERVATION
IN
AUSTRIA AND CZECHOSLOVAKIA

ANDRE' MAYER FELLOWSHIP, F.A.O. REPORT
(May 21 - July 3, 1969)

Hudson G. Reynolds

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FOREWORD

This report briefly outlines the conservation activities visited, discussed and inspected during an Andre' Mayer Fellowship Tour of Austria and Czechoslovakia. The report is introduced by background material gleaned from ten days at the F. A. O. headquarters in Rome. Also, a brief commentary at the end of the report suggests how both fellows and F. A. O. administrators might effect meaningful studies in both America and Europe.

This report should be considered tentative since specific statements are yet to be checked with authoritative individuals and organizations. Moreover, there has been no opportunity, as yet, to review thoroughly the available literature.

STUDY OBJECTIVES

The study endeavored to determine: (1) the significance of wildlife to the specific cultures of European countries, (2) the coordination of wildlife production with other land use activities (e.g. wood production), (3) methods for habitat improvement to effect better wildlife populations, and (4) the control of wildlife populations by recreational harvesting and other methods.

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F. A. O. HEADQUARTERS, ROME

INTRODUCTION

Orientation as to purpose, function and objectives of the fellowship activities in the field of wildlife management was provided by a brief visit to F.A. O. Headquarters in Rome, Italy.

A brief summary of this orientation is included in the report as background for prospective wildlife fellows who might study under auspices of the Food and Agricultural Organization of the United Nations.

This section covers briefly the organization of the United Nations, the origin and function of F.A.O., the objectives of the Andre' Mayer fellowships, and some of the international problems of wildlife management and suggested research approaches for their solution.

UNITED NATIONS ORGANIZATION

ORIGIN

The United Nations can be best described as a "family" composed of several affiliate organizations. U.N. is an outgrowth of the F.A.O., which was conceived at a world conference called by President Franklin Roosevelt in May 1943 in Hot Springs, Arkansas. It became a formal organization as a result of a follow-up conference in Quebec, Canada in October 1945.

In 1949 an Expanded Program of technical assistance was developed by United Nations and related agencies. This Expanded Program helps to plan and to coordinate activities of technical assistance within the United Nations, and eight related agencies, namely; the International Labor Organization (ILO), the Food and Agricultural Organization (FAO), the United Nations Educational, Scientific and Cultural Organization (UNESCO), the International Civil Aviation Organization (ICAO), the World Health Organization (WHO), the International Telecommunication Union (ITU), the World Meteorological Organization (WMO), and the International Atomic Energy Agency (IAEA).

PROGRAM

The general function of the United Nations Expanded Program is to reinforce national programs in support of various facets of poverty. This function is pursued by providing experts, fellowships, supplies and equipment to underdeveloped countries throughout the world. This approach is supplemented by provision for training centers and institutions, seminars and study groups all under the leadership of qualified instructors and demonstrators.

Emphasis of the program since 1950 has been as follows: 71 percent of funds for expert assistance, 18 percent for fellowships and 11 percent for equipment. Distribution of operating costs among the participating agencies in 1961 was as follows:

Organization	Allocation $
UNATO	8,806,838
ILO	4,274,019
FAO	10,589,053
UNESCO	6,593,104
ICAO	1,534,750
WHO	6,912,445
ITU	804,465
UMO	636,622
IAEA	768,704
	40,900,000

F. A. O. RELATIONS

The Food and Agriculture Organization is now one of the members of the United Nations family. The primary concern of F. A. O. is development of world forests, fisheries and farmlands to meet the needs of man for food, shelter and clothing on a world-wide basis.

F. A. O. is the largest group in the U. N. "family." It is organized under a Director General. Departments within F. A. O. include: (1) an Agricultural Department, (2) a Fisheries Department, (3) a Populations Department, and (4) a Forestry Department (a proposal to be consumated in 1969).

Each department is divided into a number of divisions. Within each division are several branches. Within the branches there are subdivisions known as sections. At present, the wildlife function falls within a section; however, a proposal is being considered for raising the wildlife function to a "branch" status.

UNITED NATIONS DEVELOPMENT PROGRAM -

ANDRE' MAYER FELLOWSHIPS

OBJECTIVES

The United Nations Development Program is concerned with technical research and research training that can be provided through fellowships. General objectives of the Program are to disseminate information, to provide facilities for training and to organize the handling and awarding of fellowships (about 900-1000 annually).

The Development Program is funded by FAO allocation and grants from private organizations and institutions e.g. the Rockefeller Foundation. About 3 millions are provided annually by F. A. O.; an additional 1 million dollars originates from grants.

The program of fellowships, was established within United Nations in 1956 under the name of Andre' Mayer, who was a source of inspiration and guidance to F. A. O. for many years.

Research Fellowships are granted to unusually promising individuals of proven research ability who are capable of independent and original research work involving collection and analysis of either new or existing data. Research Training Fellowships are made for the purpose of training young, and promising individuals, who have demonstrated an inclination toward and an appitude for research work, and who would benefit from additional research experience.

Fellowship awards are made to member countries for the promotion of research projects. The Fellowships are meant to help supply qualified scientists throughout the world, who can apply themselves to problems peculiar to developing countries, to enhance economic programs and welfare development. FAO, although not a research institution, has a responsibility to foster research in fields of interest to member nations. Fellowship awards have proven an excellent medium for discharging this responsibility. More recently, awards have been extended to members in more advanced countries with the restriction that a balance would be maintained with awards to members of undeveloped countries.

CURRENT PROJECTS

In 1967 there were 49 countries participating in the Andre' Mayer Fellowship Programs. Numbers of research projects under the various categories is tabulated below:

Research Category	Number of Projects	
	Research	Training
Animal Production and Health	18	-
Land and Water Development	7	5
Plant Production and Protection	17	5
Forestry and Forest Products	9	2
Nutrition	9	-
Fisheries	9	-
Commodities	1	-
Economic Analysis	5	2
Rural Institutions and Services	1	1

WILDLIFE RESEARCH GUIDANCE

Wildlife research projects come under the Forest and Forest Products category. Technical guidance for research is supplied by the Wildlife Section in the Department of Agriculture within F. A. O.

The Wildlife Section is associated with the Agricultural Department for a number of reasons, the most significant of which are:

(1) In most countries of the world National Parks or Reserves are under the administration of a State or National Forest Service.

(2) A network of foresters exists throughout the world, that serves to practice, extend and innovate rules of conduct for the conservation of natural resources, including wildlife.

(3) Working parties for studying wildlife problems can be attached to and work within already established forestry organizations.

(4) Most Forestry Schools of the world either teach wildlife courses or are closely allied with departments that do teach the science of wildlife management.

(5) Foresters throughout the world all have some application of or training in: (1) Land management planning, and (b) Multiple use planning.

WORLD WILDLIFE PROBLEMS

World wildlife problems are associated with land use patterns. Some concept of present world-wide problems provides an excellent background for an evaluation of wildlife problems in western Europe. Accordingly, general problems of land use, wildlife management problems and unique possibilities for studying wildlife throughout the world are reviewed briefly.

GENERAL LAND USE CONCERNS 1/

Evaluation Criteria.--The development of stable patterns of land use for sustained production of wildlife involves three major disciplines - social, economic and ecological. None of these disciplines can be ignored in either analyzing land use problems nor in developing programs for stabilizing the economy and welfare of a country. Ecology largely sets the extreme limits of land use. Economics determines what land uses are monetarily possible. Social consideration determines priorities of effort and the time factor for scheduling better patterns of land use. In determining the suitability of a land area for the development of a wildlife resource, criteria, representative of each of the three disciplines, should be used.

1/ Based upon publications by Thane Riney (see Bibliography)

Possibilities for development or expansion of the wildlife resource on large areas can be estimated by determining how existing land-use forms in small parts of the area or on nearby areas have already been adapted to social, economic and ecological variables. In the development of a betterment program, it is well to remember that, socially and ecologically, gradual development is preferable to rapid large-scale changes. If development is gradual, homeostatic mechanisms come into play and provide direction and stability to the program. Such homeostatic mechanisms even work within a particular government. For example, when a proposal is made by one function of a government, another function is likely to object or to propose alternatives from which compromises can be constructed.

There are several considerations basic to the use of evaluation criteria. First, any development project must be so designed as not to destroy the land resource upon which it is based. A safe minimum standard of conservation should always guide proposals. Secondly, criteria of social, economic and ecological significance should be synthesized so that there is no confusion of objectives.

Some of the important variables that should always be considered are: (1) the number and quality of technical and administration staff, and the provisions being made to further their training; (2) the existing organizational structure and how it facilitates, or hinders, accomplishment of departmental objectives; (3) the number of native species still existing in undisturbed environments, (4) the extent to which habitats have been changed by development activities, and possibilities for restoration or enhancement; (5) amount and source of national incomes; (6) kind and interspersion of land use activities; (7) the present and potential domestic recreational demands; (8) the tourist potential and its significance to national development; and (9) the status of research in relation to management and administrative needs.

Alternative uses.--In developing any habitat for potential wildlife use, alternative proposals should always be considered. Seldom is there only one possible solution to a problem. Usually, a number of acceptable solutions are possible within the restrictions imposed by economic, social and ecological restraints. The problem often comes down to eliminating less desirable and unacceptable solutions and choosing intelligently among the remaining acceptable solutions.

Assuming a productive and variable land base, there are always several patterns of land use possible. It is axiomatic that the poorer the land base, the fewer the land-use alternatives possible.

An axiom in wildlife habitat management is the more variable the habitat conditions the more likely any given species will satisfy its specific habitat requirements. Few species prefer a monotonous habitat. Moreover, a diverse habitat will likely contain a greater variety of species than a semi-monotonus habitat.

Another principle applicable to habitat management is the concept of interspersion. Many wildlife species require several habitat conditions within their daily cruising radius e.g. feeding, resting and sleeping sites. It follows that if specific habitat conditions are widely dispersed a greater number of animals should be accomodated.

Both diversity and interspersion should be considered in deciding upon the best alternative among several land uses. Often the same over-all results can be obtained with minor concessions to wildlife habitat enhancement.

Land for Wildlife.--Wildlife production is now recognized by most countries as a legitimate land use. Both society and the individual benefit from wildlife. Not only are monetary returns possible, but intangible factors of national pride and personal inspiration are operating. Many governments recognize these values and have taken positive steps to conserve wildlife.

Nearly all kinds of land produce some form of wildlife. Kinds of land adaptable for wildlife use includes: (1) arable lands, (2) forest lands, (3) grazing lands and (4) non-productive land (e.g. mountains, swamps and deserts).

Lands managed for agriculture, forestry and grazing are now recognized as appropriate for wildlife production. Also, in many countries, large areas, marginal for agriculture, have deteriorated as a result of improper use. Here, wildlife production could become as an important temporary or permanent use. Attempts to use lands of low fertility, shallow soil or poor precipitation-evaporation relations can only result in exploiting resources from better lands to do so. Some such lands would probably return more to society if dedicated primarily to wildlife use.

A serious and undesirable development has already or is now occurring on marginal lands. Land can deteriorate under improper use to the point where the depletion trend cannot be stopped nor reversed. No land should be permitted to reach this threshold of irreversitility of deterioration. Ecologically downward trends should be recognized and abated. Emphasis on conversion of these lands to wildlife use should enhance the possibilities for reversing downward trends.

There are three general situations where wildlife production is an especially appropriate form of land use. These are: (1) where land has already been dedicated to wildlife use; (1) where wildlife use is a better social, economic and ecologic form of land use; and (3) where more productive forms of land use have proved impractical e.g. abandoned farm land. Under such conditions wildlife use can either become permanent, or temporary while land is being restored to its former more intensive use.

Wildlife Utilization.--Wildlife has many uses. Among the more important are: (1) hunting for sustenance, (2) hunting for sport, (3) trophy acquisition by gun or camera, (4) parks or reservations for attracting tourists or other non-consumptive uses, (5) commercial use of animal products (e.g. meat, skins, antlers) and (6) sale to zoos.

Legislation - Administration - Education.--Many facets of these areas are not yet fully developed for wildlife management. In the field of legislation, laws should be adequate to: (1) prevent extermination or to insure a continuous supply for a specific purpose by establishing a technical, administrative and enforcement arms of government; (2) provide for rational harvest by sustenance hunting, sport or trophy hunting, or commercial exploitation, (3) safeguard the health of domestic animals and (4) protect human health. In some cases international laws are necessary to prevent misuse, over exploitation, extermination or international traffic of a wildlife species.

Normally, administration of a wildlife resource falls to the lot of government. Hence, machinery must be set up within local states or federal governments for efficient, systematic and rational administration of the wildlife resource.

Education must be a continuous and widespread effort in wildlife management. Schools must exist for both professional and non-professional people in the areas of research, management, administration and extension. Adult education and public relations must be an important effort in education. Only by maintaining an informed public can the necessary funds be obtained for executing a wildlife management program.

WILDLIFE MANAGEMENT PROBLEMS 2/

A number of concerns as to the future developments in wildlife management exist on a world-wide basis. These include:

(1) Provision for proper training of individuals. At present neither the so-called "developed" nor "undeveloped" countries have adequate and proper training programs for getting what is known of the science of wildlife management or wildlife habitat management into practice "on-the-ground."

(2) Knowledge of wildlife habitat requirements is inadequate; and a science of wildlife habitat management has yet to emerge.

(3) As yet the concepts of range management, as developed for and applied to domestic livestock, have not been adopted fully by wildlife managers.

(4) Introduction of exotic species is gaining impetus in many countries. Knowledge of the reactions of exotics to new environments and the impact that they might have upon endemic flora and fauna is inadequate for intelligent introduction of exotics.

2/ op. cit., p 9.

The experience of New Zealand relative to the introduction of exotics illustrates some of the problems that can develop. Between 1850 - 1914, New Zealand introduced 15 species of mammals. At first, each species population responded by irrupting. Eventually, however, each population stabilized, but oscillated about an average. The characteristic of the organism - environmental complex, which produces irruptions, seems to be some element of change, which is introduced into the complex. Thus, lack of adequate habitat for expansion can serve as a brake on irruptions.

There is evidence that change in the composition of an animal population controls population dynamics. For example, adding a male or female to a population, or deleting a male or female from the population, produces an increase in the population.

(5) Problems of animal damage to forestry and agricultural crops still exist in most countries of the world. The problem seems to involve inadequate analysis of the problem by people with a broad, analytical grasp of the interrelations between wildlife and other economic products of the environment.

(6) Social and philosophical problems of wildlife harvest or cropping in many countries have not been solved. Some countries crop animals by sport-hunting on a democratic basis. Other countries prefer to designate kinds and number of animals to be removed under a "single package" arrangement to monied "sportsmen." Still other countries prefer the slaughter of large animals by a select group of designated hunters.

(7) Herd management plans for various species of wildlife in numerous countries are inadequately developed because of lack of dispersal of known facts and inadequacy of knowledge.

(8) Private organizations and foundations are now pursuing considerable research and practice of wildlife management. In general the work of these groups is not being widely disseminated among other organized groups in wildlife management.

(9) Many lands, submarginal for agriculture, of the world have been cultivated in the past. These lands need to be stabilized and refurbished. Possibly, their most important use in the future will be for forestry and related uses, including wildlife.

(10) The fact of a "conservation threshold" for land use is not well appreciated world-wide. "Threshold" refers to a degree of use of land, which, once exceeded, may make impractical or impossible its restoration to a high state of productivity.

UNIQUE WILDLIFE RESEARCH AREAS 3/

Certain areas of the world have unique characteristics which adapt them to wildlife management research. These are:

(1) North America - The contribution of this area lies in the science of range management, wherein the interrelations of domestic livestock and forage plants is now fairly well understood. Also, North America is pioneering work on the reaction of woody plants (browse) to top removal by artificial (clipping) and natural means (browsing).

(2) New Zealand - This area provides an excellent outdoor laboratory for the study of response of exotic animals to new habitat conditions and the impact of such animals upon existing habitat. Study possibilities are enhanced because the ecological complex is relatively simple.

(3) Africa - This area offers an opportunity for study of a variety and complexity of Pleistocene forms of both plants and animals. Geologic evolution has produced a great diversity of organisms many of which have survived to recent times.

3/ Based largely upon interviews with Dr. Thane Riney.

(4) Europe - This area, particularly Czechoslovakia and Hungary, offer an opportunity to study the consequences of sustained land use upon the maintenance of wildlife species.

(5) Australia - This area offers a unique opportunity for study because of the survival of marsupial forms that exhibit a high degree of adaptive radiation.

(6) Tundra - Perhaps the response of tundra forms of wildlife might best be studied in Russia or the Scandanavian countries. At any rate, the relations between organism and environment need to be studied for tundra conditions.

SOME COORDINATION PROBLEMS

Wildlife occupy lands that may be used concurrently for production of timber, livestock, water and recreation. In some cases, conflicts of interests occur; in other instances, slight modification of such practices as logging and grazing can enhance wildlife production. More needs to be known of the interrelations of multiple land-uses so that best overall returns can be obtained from a land unit.

GENERAL PROBLEMS

Under multiple use management the objective is that of permitting as many uses as possible consistent with ecological limitation, economic possibilities and social or institutional constraints. By and large, wildlife are accepted as a part of multiple use management.

Where management of the forest is directed to wood production wildlife becomes a secondary consideration often to the extent of holding populations of browsing animals down so as not to interfere with forest reproduction. At present, the general trend is to grow more wood on the more productive areas. Hence, reduction of animals on these intensively managed areas tends to be compensated by yielding of areas to wildlife.

Where management is directed to watershed or recreation, wildlife are more compatible with other objectives. In fact, grazing and browsing animals, if properly managed, can enhance the primary objectives by helping to control understory growth. Where domestic livestock and big game animals compete with each other land managers must reach a decision as to a desirable balance and then attempt to maintain it by controlling numbers of both livestock and game. In general, it is more efficient ecologically to graze combinations of animals rather than a single species, particularly if the vegetation is heterogeneous.

Another trend of considerable importance is the tendency to introduce heterogenity into production on forest lands. Intensity of management on tree sites is geared to site productivity. Individual sites may be widely scattered so as to effect a heterogeneity of forest conditions. In fact, in most forms of land use the trend has been away from mono-culture to a great variety of production from an administrative unit.

LANDSCAPING URBAN AND RURAL ENVIRONMENTS[4/]

People are becoming more "land conscious." This has been particularly noticeable in America as a result of Stewart Udall's educational program while Secretary of the Department on Interior.

In Europe acceptance of "land consciousness" has been slower. In part, this reluctance to accept land asthetics reform stems from the long history of traditional land use that originated in Medieval times. Governments are, however, gradually breaking down resistance by aggressive action programs on State lands.

Another problem facing developers of aesthetics on European lands is the small ownership status. Acreage owned by individuals are often too small to permit individual development. Also, there is a tendency to try to apply too many kinds of land use practices on too small units.

As landscaping of natural environments develops, wildlife should play an increasingly important role. There are many opportunities to encourage wildlife in connection with "landscaping" programs.

4/ Based upon an interview with Dr. de Vos.

Encouragement of non-game species may receive additional emphasis with further development of "landscaping." Enjoyment and appreciation of non-game species is already well-advanced in some European countries - particularly Germany and the Low Countries. In these areas several assets of non-game species are recognized, including: (1) viewing animals for aesthetic appreciation, (2) the reduction of noxious insects associated with favorable insectivorous bird populations, (3) trophy contests in which check lists of species are employed and (4) the construction of nesting boxes and feeding stations to encourage such groups as owls, woodpeckers and song birds.

FOREST MANAGEMENT PROBLEMS [5/]

The possibilities for wildlife habitat management are effected by developments in forest management. In fact, the use of ax and fire in connection with forest management are most proficient means for developing wildlife habitat, provided that they are used wisely. Hence, forest management trends can effect developments in wildlife management.

Some of the developments in forest management in Europe, are:

(1) The non-wood uses of forests are gradually increasing.

(2) Wood prices are rising as the cost of production increases. This trend is being offset somewhat by (a) operating on larger more economical land units and by (b) adopting more efficient mechanized methods in woods and mill.

(3) Methods of forest management are gradually becoming more sophisticated. An example is the use of computers in connection with forestry inventory, analysis, and decisions as to the most profitable alternatives for cutting.

5/ Based on an interview with Mr. Andersen, silviculturist, Dept. of Agriculture, F.A.O.

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(4) Management methods are becoming more intensified. Some examples of intensification are:

(a) Fertilization as a means of establishing young trees and promoting the growth of old trees is now a reality.

(b) Biological control of insects and disease is now rather widely accepted and practiced.

(c) Genetical knowledge--particularly of seed sources--is now employed as a practical tool in forest management.

(5) In the past there has been considerable emphasis on the damage resulting from the presence of wildlife on forest lands. More recently, land owners have become aware of the revenue associated with the lease of hunting rights. As a result, a better balance is being reached between the use of forest land for wood and game production.

(6) The growing demand for better quantity and quality of water is bringing about a growing competition between the use of forest lands for water yield and timber production. Management of a forest for water production may be more compatible with wildlife use than management for wood production.

AUSTRIA

INTRODUCTION

Significant studies while in Austria included visits to: the Forest Research Institute and Lainzer Tiergarten in Vienna; and the Department of Botany ,Univ. of Innsbruck, the Tyrol Province Forest Administration, the Tyrol Province Hunting Club, and the Alpen Zoo, all in Innsbruck.

AUSTRIA'S FOREST 6/

Austrian forests occupy over 8 million acres or about 40 percent of the total area of the country. Forests occur mostly at the higher elevations where topography is steep and temperatures severe.

Austrian forests are primarily coniferous. Spruce (Picea) is the most abundant; pine is second, larch (Larix, spp.) is third. Of less abundance are fir (Abies spp.), Austrian pine (Pinus australis) and cembra pine (P. cembra). Hardwoods occupy 16 percent of the total area of forests. Beech (Fagus spp.) and several species of (Quercus spp.) are the main species of hardwoods. Riparian species are limited to one percent of the area.

6/ See Bibliography on: Austria's Woodlands. 1965. Austrian Forestry Assoc., Vienna. 28 pp. (In English)

HISTORY OF USE

In the early days (centuries to thousands of years ago) many mountainous areas of the central Alps were deforested to enhance agriculture and grazing. However, about 450 years ago deforestation was abetted by state legislation, so that clearing now must be authorized by state officials.

More recently, there has been an exodus of farm people to the cities because of farm mechanization. This exodus has permitted forests to reoccupy abandoned areas, particularly on the steeper areas of low productivity. Agriculture has not suffered, because more intensive farming has resulted in higher production on lesser acreage.

There was considerable overcutting of farm forests while farms were being mechanized and electrified. Forest cutting furnished the revenue for the conversion. Overcutting still occurs in some isolated, underdeveloped areas. Here, the solution to overcutting will require consolidation of holdings, better education and information, and farm relief measures.

Overgrazing has also been common on many forest areas for centuries. The result has been a great reduction in forest growing stock on grazed areas--to less than 1/2 of normal.

OWNERSHIP

Ownership of forest lands in Austria is as follows:

Ownership	Percent
State Forests	14
Community Forests	6
Communal Forests	6
Ecclesiastical Forests	4
Private (> 150 ac.)	26
Private (< 150 ac.)	41
Other	3
Total	100

Austrian state forests are directly under the Minister of Agriculture and separate from the forest authority which comes under the ministry (Fig. 1.). In community and communal forests 20 percent of the revenue is returned to the community administration for maintenance of such items as schools, council houses and bridges.

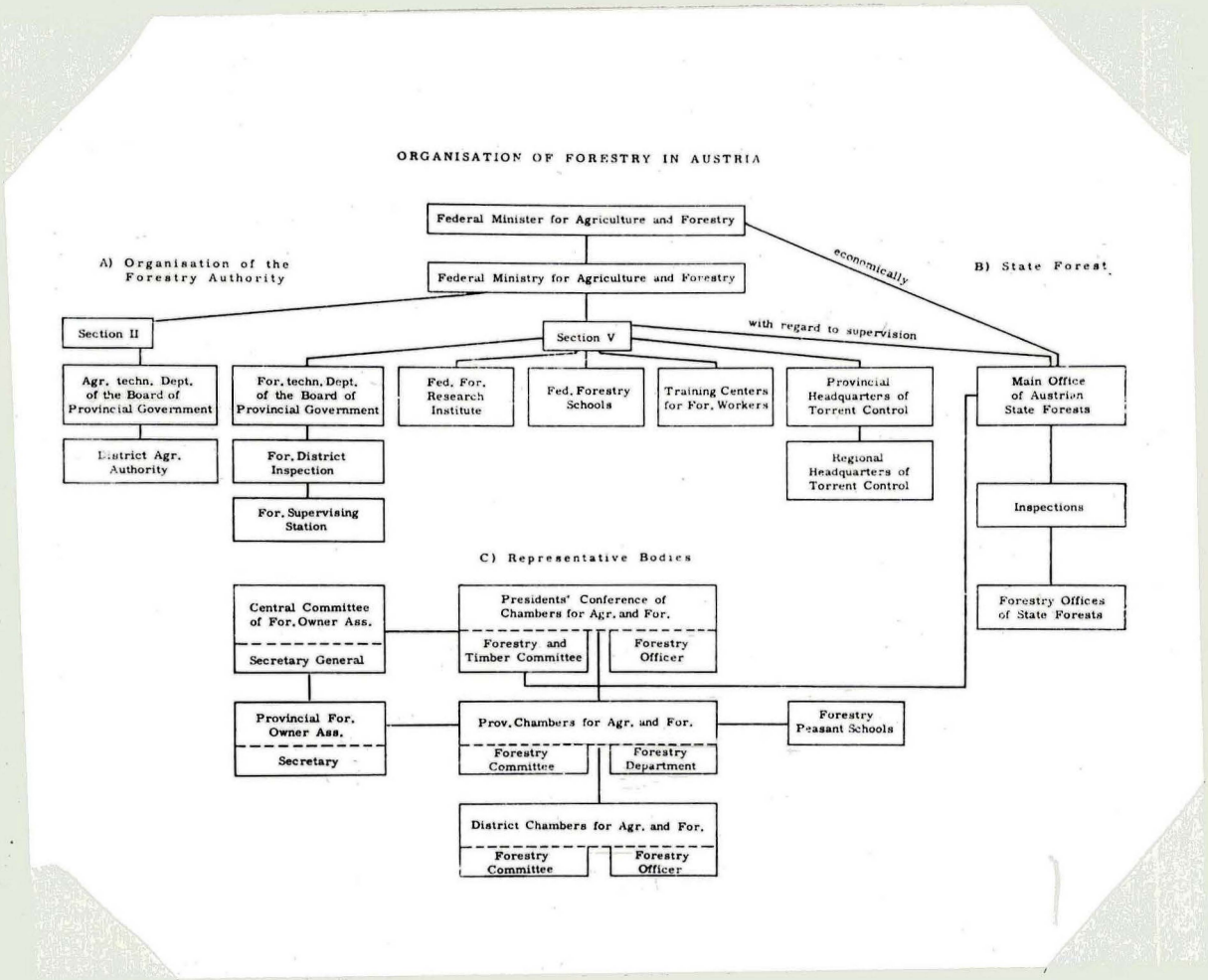
ORGANISATION OF FORESTRY IN AUSTRIA
Federal Minister for Agriculture and Forestry
A) Organisation of the Forestry Authority
Federal Ministry for Agriculture and Forestry
economically
B) State Forest
Section II
Section V
with regard to supervision
Agr. techn. Dept. of the Board of Provincial Government
For. techn. Dept. of the Board of Provincial Government
Fed. For. Research Institute
Fed. Forestry Schools
Training Centers for For. Workers
Provincial Headquarters of Torrent Control
Main Office of Austrian State Forests
District Agr. Authority
For. District Inspection
Regional Headquarters of Torrent Control
Inspections
For. Supervising Station
C) Representative Bodies
Central Committee of For. Owner Ass.
Presidents' Conference of Chambers for Agr. and For.
Forestry and Timber Committee
Forestry Officer
Forestry Offices of State Forests
Secretary General
Provincial For. Owner Ass.
Prov. Chambers for Agr. and For.
Forestry Peasant Schools
Secretary
Forestry Committee
Forestry Department
District Chambers for Agr. and For.
Forestry Committee
Forestry Officer

Figure 1.--Organization of forest authorities in Austria.

ADMINISTRATION

All forest owners of more than 1 1/4 acres are required by law to become members of the Chamber for Agriculture and Forestry. Members are entitled to receive legal council, to vote, and to hold office. Also, forestry experts provide advisory and technical assistance to members.

At the State level a Forestry Section reports to the Ministry for Agriculture and Forestry. Within the Section are the Federal Forestry Research Institute, and four Federal Forestry Schools and Forestry Training Centers.

At the provincial level, there are Technical Forestry Departments of the Boards of the Provincial Governments. At the district level the administration is by District Forestry Inspection.

Also, under the Forestry Section is a branch concerned with torrent and avalanche control. In addition there is a special service organization of foresters which cooperates with all other forest authorities and with authorities in the agrarian section.

All foresters in Austria belong to the Austrian Forestry Association. There are similar organizations at the provincial level. Membership is voluntary.

The Federal Timber Council (also Provincial Timber Councils) is a committee of the President's Conference of the Agricultural Chambers as well as the Federal Chambers of Industry and Commerce. This association coordinates the interests of professional forestry, timber industry and timber grade in questions of foreign trade policy, information and cooperation, and international relations generally.

MANAGEMENT

Nearly all Austrian forests are managed as "high" forests. Only 1.5 percent of the forests are managed as coppice; and another 1.0 percent as coppice with standards.

High forests are managed mostly by clear-cutting in small patches on a rotation of 80-120 (sometimes 140) years. Forest regeneration is by both natural and artificial means. Larch and pine are most susceptible to natural regeneration. In general, a growing stock of 200-250 m^3 per hectare is considered normal.

EDUCATION

Training of the forest owners in forestry is conducted by offering them an extensive system of courses, during the winter months. In addition, hundreds of agricultural and forestry schools (mostly two-year courses) offer instruction in forestry. Forest officers are educated at the University of Agriculture in Vienna. General foresters usually attend one of four Federal Forestry Schools. Forest guards are trained by a special course of instruction. Forest workmen are required to take professional education and to pass an examination established by law. Forest research is conducted by The University of Agriculture and The Federal Forestry Research Institute, both in Vienna.

UTILITY

Forests in Austria serve several functions. In mountainous country the protective value of forests is great. Regulation of the water regime, prevention of soil erosion and protection from avalanches and torrents are important functions.

Many local residents, particularly city dwellers find recreational benefits in the forest. Also, tourists are attracted to Austria's beautiful woodlands.

Austrian forests yield about 10 million m^3 annually, more than half of which is exported as lumber, paper or furniture. Wood processing provides a livelihood for tens of thousands of people.

Almost 250,000 people hold forest property and derive some income therefrom. Today there is a gradual transition from a self-sufficient to a market economy on these holdings.

During the peak season about 6500 sawmills operate in Austria; about 2500 of these operate year around. About 25,000 people are employed in the milling industry (Fig. 2).

The cellulose and paper industry has about 100 widely-dispersed plants which employs about 10,000 people.

Figure 2.--Small sawmill operation in the Tyrol Province.

FOREST RESEARCH INSTITUTE

The Forest Research Institute in Vienna contains the followind departments:

Silviculture	Forest Economics
Genetics	Forest Techniques
Management	Forest Inventory
Diseases & Insects	Forest Soils
Wildlife Damage	

Dr. Edwin Donaubauer served as translator for most interviews. His interest in and understanding of conservation is broad, and his command of English is good. As a result, little difficulty was encountered in conversing with various technical experts. The secret of working through an interpreter seems to be that of speaking slowly and distinctly and avoiding technical terminology insofar as possible.

WILDLIFE RESEARCH

All wildlife research at the Forest Institute is concerned with forest damage by game and other wildlife, probably with ample justification, inasmuch as forest damage by game is estimated to amount to 200-300 million schillings per year, or timber loss of 690,000 m^3.

Game Damage.--Forest damage stems from the high and increasing densities of fallow deer, red deer and roebuck. For example, for the period 1947-1967 red deer kill increased from about 9,000/year to about 33,000/year; in the same period, roebuck kill increased from 30,000 to 140,000 (Fig. 3). Current hunting regulations are not geared to reducing, but rather to maintaining, present populations of both red deer and roebuck. Hunters want to maintain high populations to enhance the sport of hunting.

Not only have population densities increased within the original range of red deer and roebuck, but these animals have also extended their ranges (Fig. 4). Both species are estimated to occupy 11 percent more area than they did 20 years ago.

Tree damage by red deer and roebuck consists of barking of older trees, browsing of terminal shoots within reach, and browsing and uprooting of tree seedlings.

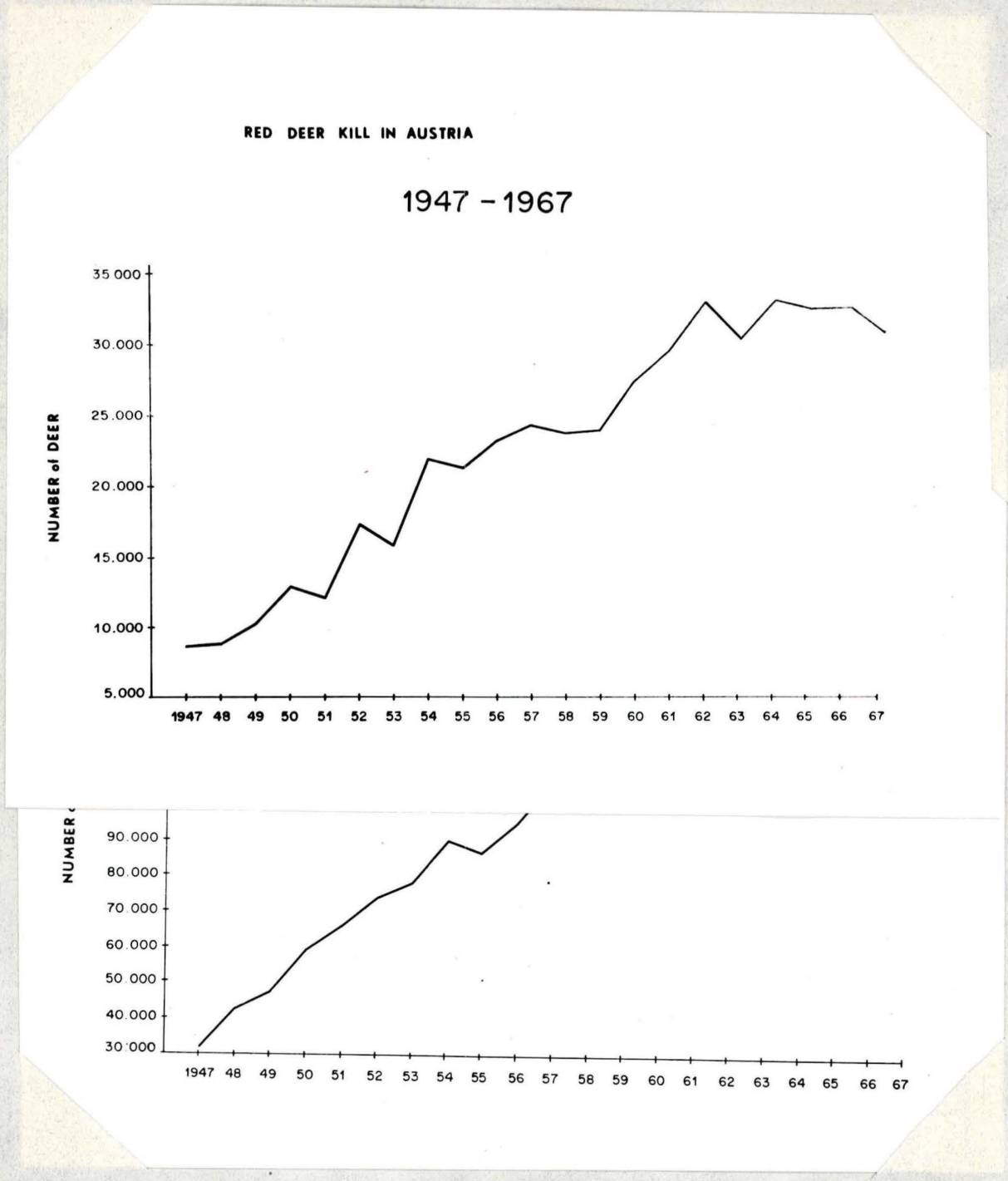

Figure 3.--Big game kills in Austria 1947-1967. Above: red deer; Below: roedeer.

Figure 4.--Distribution of Red Deer in Austria.

Estimates of proper in relation to actual densities of game animals is:

Species	Proper Stocking	Actual Stocking
Red deer	2/100 ha	4-6/100 ha
Roebuck	4/100 ha	6-10/100 ha

Greatest damage occurs where animals concentrate on winter ranges. The problem of overstocking is intensified by winter feeding to maintain high populations. The main forages used for winter feeding are chestnuts, mature hay, and some potatoes and beets. As silage feeding becomes more popular, some reduction in barking may be achieved. Animals consuming silage have less tendency to supplement their winter diets with foliage and bark of trees.

Numerous techniques have been or are being tested for reducing forest damage by game. Among these are:

(1) Use of chemical repellents.

The most effective materials tested thus far have lasted for 4 to 5 years. However, cost of chemicals is too high for the amount of protection afforded.

(2) Use of mechanical barriers.

Several effective techniques are available but all have proved too costly to be justified economically.

(3) Biological methods.

Research is now progressing towards developing special areas for providing forage needs of game within the forest to divert animals from feeding upon tree reproduction.

The problem of inadequate foraging areas within forests was intensified about 200 years ago, when foresters destroyed all willows and aspens in an attempt to convert forests to full conifer production.

Foresters estimate that 1/2 - 1 percent of a forest area should be devoted to production of forage for game exclusive of wood production. It is axiomatic that foraging areas should be well dispersed. Attention given to such forage areas includes:

(1) Giving special management attention to clear-cut areas.

(2) Providing crops plants, such as wheat (several species), sweet potatoes and sunflower.

(3) Fertilizing mature and planted forage with a NPK mixture to make forage more attractive, palatable and nutritious for game.

Other Wildlife Damage.--Some forest damage is effected by small rodents. Among the more important genera causing damage are:

Species	Remarks
Microtus	Girdle seedlings of spruce and scotts pine.
Agrestis	" " " " "
Cleithrodonomys	" " " " "
Elimoys	" " " " "
Glis	Minor damage.
Sciurus	Bark stripping sometimes a problem.
Lepus (Hares)	Damages both forests and vineyards.
Oryctolagus (Rabbits)	Damage no longer severe because of introduction of myxomytosis.

The main damage from birds is ascribed to the fir jay that feeds heavily upon the seeds of cembra pine.

Swine cause damage to agricultural crops but they are not an important factor affecting forest regeneration.

Chamois and mufflon, because of feeding habits, have little detrimental effect upon forest regeneration.

Current Wildlife Research Projects.--The most important current research projects in wildlife damage at the Forest Research Institute include the following:

(1) Biometric evaluation of actual forest wildlife damage.

(2) Physiological effect of browsing upon tree reproduction (evaluated by hand-clipping studies).

(3) Comparison of tree damage inside and outside of game exclosures.

(4) Testing of chemical repellets or deterents to reduce barking damage.

This work is conducted by Herr Smidt and one other professional man.

RELATED ECOLOGICAL STUDIES

Brief visits were made to Departments of Genetics and Silviculture, mainly to gain a broad perspective, as to ecological thinking, and the attempts being made to relate to plant and animal ecology.

Silviculture - The main silvicultural methods for Austrian forests are (1) patch, clear-cutting of conifer and (2) coppice cutting, with and without standards, for the regeneration of hardwoods. Laboratory studies (on pines) are oriented mostly to work on photoperiodism and light relations which can be applied to regeneration of forests both by natural and artificial means.

Genetics.--Forest genetics work at the Institute was initiated about 10 years previous. Most of the genetics work is concentrated on spruce (Picea abea), pine (Pinus cembra) and hybrid poplars. Research is conducted by two professionals: Muskat Ottonell and Leopold Günzl.

Work on spruce is oriented to photoperiodic differences developed under a great range of elevational differences. Seed of spruce has been collected from more than 300 different locations. Light responses of different seed sources are studies under laboratory conditions. In nursery plantings the reaction of different seed sources under similar growing conditions is measured mostly in terms of differences in number and rate of terminal bud formation.

Similar studies are being made with the cembra pine which is important for forest protection work at high elevations - namely in reforestation efforts.

There is also some work (3-4%) with hybrid poplars in the nursery. Growth responses of different hybrids are evaluated in the nursery under similar growing conditions.

The Genetics Department has a fine arboreteum established 30 to 40 years ago.

INSTITUTE FOR ETHOLOGY

This biological station is under the direction of Dr. Koenig, a student and associate of Dr. Lorenz, the famous animal behaviorist. A graduate student, Manfold Daupel, who speaks fair English, was helpful in conducting a tour of the outdoor laboratory. Koenig speaks no English, but Donaubauer provided excellent interpretative services.

The basic objective at this biological station is to study the behavior of animals in hopes that the basic principles of behavior will have some application to human ecology. Work on the conservation of wildlife is a secondary objective. Recently, this second objective has been encouraged by mounting public interest in wildlife conservation.

Initial work of the Station concerned the European heron around Neusiedel Lake. Utilization of cane for fences greatly reduced the breeding habitat of the herons. Research is concerned with habitat relations and restoration of breeding colonies of the heron.

The Station has other field study areas. Habitat relations of the black grouse will be studied in one area. Agricultural encroachment, particularly drainage projects, are destroying the habitat of this species. The black grouse is a timberline species whose existence depends upon the preservation of swampy areas.

The capercaille is another grouse that is suffering from destruction of habitat. This grouse is associated with virgin spruce stands having a good understory of Vaccinium. Logging, particularly clear-cutting and heavy selective logging, produce unfavorable conditions for the production of Vaccinum. Also, males require large virgin trees as calling sites.

The bustard is also being studied intensively. Shelterbelt work and agriculture are destroying the habitat of this species. Irrigation has extended agriculture into the prime habitat of this bird. As habitat is destroyed, the insects upon which this bird depends for existence have disappeared. Research results suggest that young birds can be conditioned in captivity to occupy a forest habitat. Eventually, conditioned birds will be released in forest habitat in hopes that they will in turn condition their offspring, and hence produce an ecologically-adapted race of birds.

LAINZER TIERGARTEN

CHARACTERISTICS

This area was formerly a hunting preserve of the Habsburg family. With the collapse of this ruling clan in 1918, the area was acquired by the City of Vienna. Since then it has been managed by city officials.

Head Ranger Beck is in charge of the preserve. A number of game keepers are under his supervision. He was gracious enough to provide a personally conducted tour of the preserve. He speaks no English, but a member of the Forest Institute furnished interpreter service. We traversed many roads that only game keepers, in the course of their duties, are allowed to use.

The Tiergarten encompases 2500 hectares, (6,250 ac.). The 12-foot stone wall, around the Tiergarten was built by one man and his wife between 1771 and 1781 at the rate of 2 1/2 kilometers (1 1/2 miles) year. The Habsburgs used the Preserve for hunting from 1778 to 1918. They constructed an impressive hunting lodge, a cathedral and several residences for game keepers, which are preserved in an excellent state (Fig. 5).

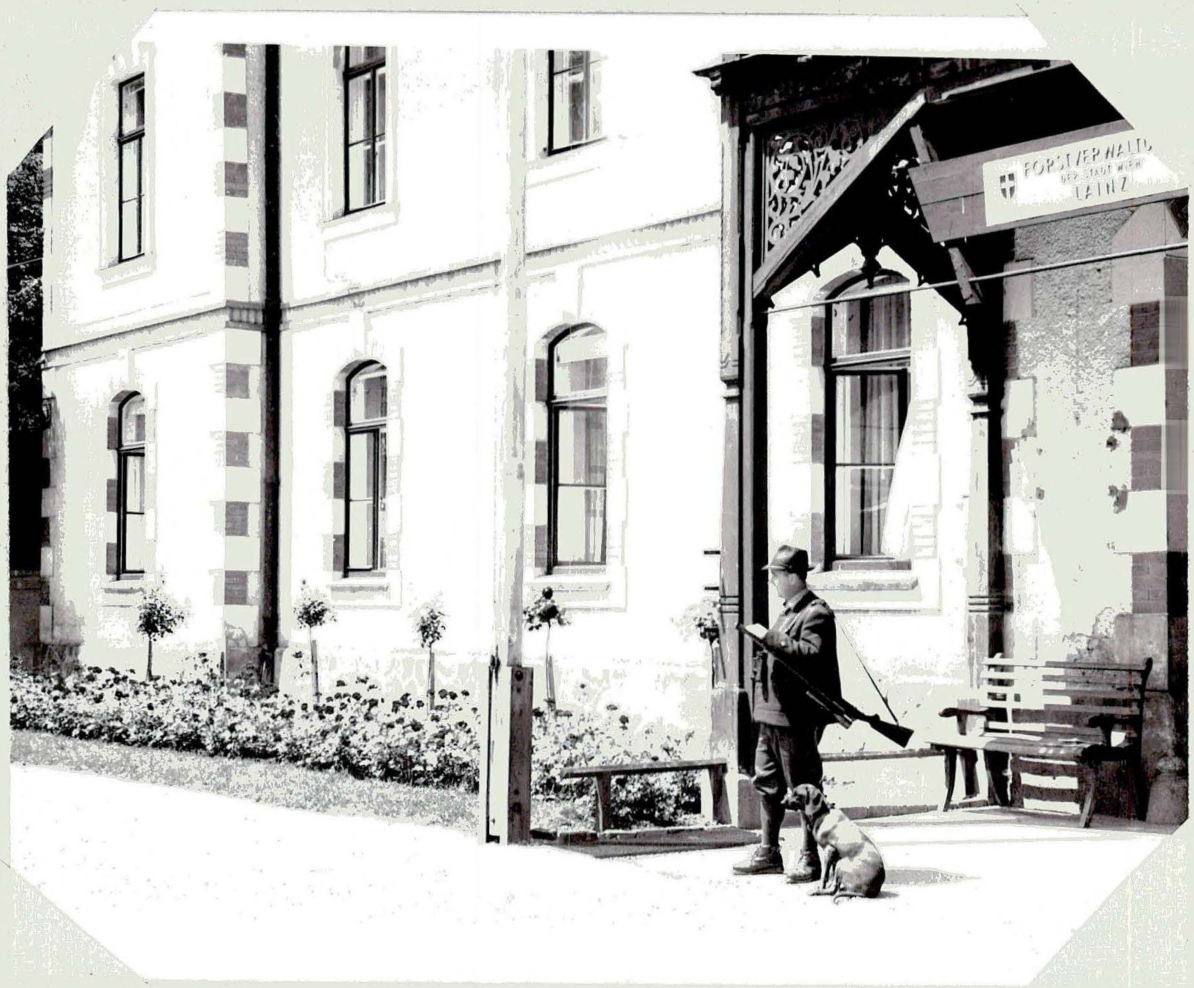

Figure 5.--Head gamekeeper "Beck with rifle and hunting dog at the entrance to the former Habsburg Hunting Lodge.

The Tiergarten was literally "carved out" of an Austrian hardwood forest. About 20 percent of the area was converted to and is maintained in glade. The remaining forest cover is regenerated by programmed silviculture. Forest composition at present is: 30 percent oak (Q. sessiliflora and Q. pedunculata), 40 percent beech (Fagus silviticum), and 30 percent miscellaneous hardwood, of which hornbeam (Carpinus betulis) is the major component.

Considerable effort is directed at propagation of two animals exterminated in Austria several centuries ago. One such species is the auroch. This animal died out in Austria after the 30-Years War of the 17th century. The Tiergarten obtained a breeding stock from German biologists in 1968. This population is now being propagated within an enclosure on the Preserve.

The wild horse of Austria was exterminated about 800-1000 years ago. German breeders obtained a small stock from the Caucus of Russia where the animals still survive. The Tiergarten acquired breeding animals from Germany in 1961. Eventually, offspring of this breeding herd will be released in suitable habitat in Austria in an attempt to restore this species in the wild.

HABITAT MANAGEMENT

Habitat management, presumably worked out by trial and error, maintains a balance vegetation and animal needs. Open glades of native grasses and forbs are maintained with herbicides which suppress tree reproduction.

Forest cover is maintained by annual cutting of old growth trees. Initially, 5-6 hectares of Tiergarten Forest are cut in widely dispersed, 1/2-hectare plots. Seed trees of oak and beech, but not hornbeam, are left in each plot for a seed supply. Cutover areas are fenced to prevent game from destroying advance and subsequent tree reproduction.

After reproduction is established, seed trees are cut. When reproduction grows to a height where it will not be affected by browsing the protective fences are removed.

GAME MANAGEMENT

As a result of the confining wall, an accurate accounting can be made of animals within the preserve. At present, numbers of animals by species and the number removed each year by hunting are:

Species	Population No./2500 hectares	Annual Kill
Red deer	120	25±
Swine	600	400-500
Roebuck	50-60	20±
Mufflon	500	20-30 by hunting 20-40 for meat
Fallow Deer	290	50±

Hunting to remove annual reproduction of animals is by permit. Aristocracy are given first preference on permits; second, preference goes to the monied class; third, government officials are permitted to acquire any remaining permits; finally, if permits are still available, they are issued to lay people, on a first come, first serve, basis.

Game keepers indicate the kind, number, and actual individuals to be removed from the Tiergarten. Hunters occupy observation towers on an assigned basis. Hunters acquire only trophy heads from their effort; meat is sold at auction to lay people.

Supplemental feeding is resorted to during winter months. Actual amount of feeding depends upon the severity of the winter. Winter feed is stored in barns and feed out daily by gamekeepers, as needed (Fig. 6). Supplements at established feeding stations consist of grass silage, hay, chestnuts, turnips, and mineral supplements. Some of the feeding racks are so constructed that roebucks can gain access, but red deer, mufflon and fallow deer are excluded.

Figure 6.--Storage shed for supplements which are feed to game animals during severe winters.

BOTANY DEPARTMENT

UNIVERSITY OF INNSBRUCK

The Department of Botany has been engaged in ecological studies of subalpine flora for a number of years in cooperation with the Department of Agriculture Section on Torrent and Avalanche Control. Prof. Dr. Gams (now retired) proved a good contact inasmuch as he speaks fair English. Prof. Tranquilli, plant physiologist, with the Department also speaks some English.

Muller (1963) summarized in English some of the results of ecological investigations in the Alps. Some of this material is paraphrased below to indicate the kind and intensity of ecological investigations.

For many centuries alpine forest lands of Austria were converted to arable lands. This converstion has favored the development of avalanches and erosive torrents. In fact, two-thirds of the avalanches in Tyrol originate from regions where forests have been destroyed. Reforestation is considered essential for the restoration of stability at these high elevations. Ecological research was necessary to make possible practical reforestation.

Both plant sociological and climatic measurements are included in the research program. The relations between habitat, ground relief and vegetation are correlated on maps. Indicator plants are used to suggest possibilities for reforestation. Areas excluded from research are those of limestone soils, or those influenced severely by mowing, grazing or fire.

Besides work on the relations of climate, soils and plants, physiological studies of growth have also been pursued. The remaining problems, which are being investigated by phytotron and soil moisture measurements, include such things as water relations, nutrient deficiencies, and adaptability of plants to specific environments.

AVALANCHE AND TORRENT CONTROL

INNSBRUCK BRANCH

GENERAL APPROACH

Dr. Schielel, of the Avalanche and Torrent Control Section in Innsbruck, talking through an interpreter from the Botany Department, Univ. of Innsbruck, gave a brief statement of the research work of this organization. The Branch Station in Innsbruck is one of 9 stations located throughout Austria.

The primary objective of the research of this Section is reforestation at the higher elevations. Four different research groups are working on the problem, to wit: (1) A plant geography group (mainly tree distribution); (2) A ecophysiology group (work with phytotron and on field studies); (3) A methods of planting group (includes soil studies and soil biology investigations) and (4) a windbreaks group (artificial means only).

The Branch Station at Innsbruck is concerned mainly with the mapping of natural vegetation including studies of tree ecology. Work is concentrated on cembra pine. The work includes the following investigations:

(1) Determination of the present distribution of the (cembra pine) species and the ecological factors of environment that control distribution.

(2) Locating potential areas for reforestation based upon ecological and climatic adaptability knowledge of the species.

(3) Mapping potential reforestation sites from knowledge of (a) soil, (b) climate, (c) avalanche activity, (d) exposure, (e) slope and (f) economic factors.

This station also conducts research on microclimate. Both permanent and mobile equipment is employed. Development of instrumentation for measuring both climatic and biological factors of the environment poses a difficult problem.

GENERAL RESULTS

Some early results of the investigations of this research section have been published. 7/ A few highlights of the findings are paraphrased below to indicate the kind and depth of research being conducted.

The primary objective of the Innsbruck Research Center is to determine how to successfully reforest lands near the climatic timberline, particularly, where lands have been cleared previously in the interest of creating pasturelands. Two research approaches are used. One is an ecological approach involving surveying and mapping of ecological parameters. The other approach is concerned with physiological investigations of individual plants, but with an ecological orientation so that findings can be adapted to field practice (von Friedel, 1965).

Microclimatic cartographic studies have revealed that great ecological differences in alpine zones can be referenced to: (1) the duration of snow cover during the spring months and (2) the duration of insolation on cloudless days. (von Friedel, 1965). By making suitable corrections, configurations depicting these two variables can be plotted on maps to assist in the isolation of areas suitable for reforestation.

7/ See Bibliography.

An up-to-date automatic recorder for counting and summing climatic conditions in the subalpine zones has been devised. To quote:

> "Assorting is done with the aid of special weather-factor threshold-value recorders by processing the measured values from the individual sites in the field through relay devices by various measuring instruments according to atmospheric conditions." (Prutzer and Cernusa, 1965).

Large areas of former subalpine pasture in the Lower Inn Valley were reforested in 1953. Run off measurements are being made to determine the effects of reforestation on the water regime (Schiechtl, 1965).

Vegetation records on selected sites are used to establish a correlation with climatic and site factors. Measurements include dominance of a species, density and height of the population, community stories, and indicator plants. Comparison measurements are made of such ecological factors as wind exposition, depth of snow, radiation balance, soil maturation, soil depth, amount of podzolization and human influences. Maps of these data are prepared for projecting the possibilities of reforestation (Neuwinger, 1965).

Studies are being made of the mycorrhiza in stands of cembra pine and Norway spruce (Gobl, 1965). State of mycorrhiza is measured by counting individual units and by identifying different units. Qualitative analysis has shown that vigorous stands of spruce contain a greater diversity of mycorrhiza forms than poorer stands. Some forms of mycorrhiza are specific to the two stands.

Drift-damming constructions have been used to protect plantings and to reduce the damage of avalanches. Bernard (1965) found that:

> "Four years of comparative measurements inside and outside the radius of action of these constructions revealed an increase of snow resistance within their radius, a decrease of snow-height on the leeward detachment slopes, and the prevention of snow-drift formation."

TYROL FOREST SERVICE

Each province in Austria has a Forestry organization under a Head Forester, who oversees a number of districts. The organization is similar to the U. S. Forest Service organization, except that province Heads report directly to the Ministry of Agriculture instead of through a Chief Forester as in America.

Mr. Koller heads the Tyrol Province Forestry. We spent one day reviewing problems of forest administration on the ground. Interpretation was handled by a young Austrian university graduate who had spent three years in America as a ski instructor.

The Tyrol Province is well advanced in utilization of the "full" forest, or what in America is known as the "multiple-use" forest. The Tyrol Province has about 90 years experience in what they term LANDWIRTSCHAFTLICHEBETREID. Problems of multiple use in Austria are complicated by the fact that three different organizations are concerned with wild land use, to wit: the Forest Service, the Avalanche and Torrent Control Service, and the Province Game Management Group.

GRAZING PROBLEMS

Grazing was an early problem of land management in Tyrol and has not yet been completely solved, although much progress has been made. Some management of wood cutting has been practiced since 1300 A.D.; management of grazing on farm woodlots has been in effect for about 130 years. Within the last 10-15 years recreation management or tourism has been recognized as a problem of forest administration.

In the early days farmers grazed many cattle and sheep at the tundra elevations and also let animals run free in the woods. Moreover, they cleared much forest land to create natural pastures (Fig. 7). As a result, the area of forest was reduced; and the forested lands which were grazed, became poorly stocked with trees.

Two economic events helped solve the forest grazing problem. Scientific logging intermittentently creates areas where livestock can graze without seriously interferring with advance reproduction. Secondly, the construction of ski slopes has produced clear-cut areas, which, when refurbished with grass, furnish grazing sites. Livestock graze such areas in preference to near-by woods, and pressure upon tree reproduction has been relieved.

Figure 7.--Area of forest that was cleared to create pasture for livestock.

Grazing problems still exist. Traditionally, farmers have grazed livestock. They are not easily convinced of overproduction of livestock or forest damage. Actually, there is presently an oversupply of cream, milk and butter in Austria. At these higher elevations, within forested regions, an average farmer's income is divided into 50 percent from cattle, 30-40 percent from wood and 10 percent from tourism. Agriculture, mainly potato-raising, constitutes a minor part of the farming enterprize.

FOREST DAMAGE

Wildlife pose a difficult problem to Tyrol forestry because of ownership of game by the private individual, and management by an organization (Tiroler Jagerverband) other than the Forest Service. High populations of game desired by the Hunter Organization result in considerable forest damage.

Game Damage.--The red deer and roebuck are responsible for 90 percent of the forest damage by game. Farmers or land owners own the game upon their property. If a landowner owns more than 200 hectares, he prepares an individual lease. For owners of smaller properties, community leases are issued. The Province Hunting Club leases hunting rights for its members, sets seasons and bags and makes awards to proficient hunters (Fig. 8).

Figure 8.--Hunting lodge and cabin that are leased from landowners by the Tyrol Hunting Club.

"Barking" damage to trees is mainly caused by red deer. Both red deer and roebuck defoliate reproduction; both also decapitate and pull up seedlings. Where there is heavy damage potential, such as in winter concentration areas, fencing is used to protect forest regeneration until it grows out of reach of browsing animals.

Where there is considerable damage to tree reproduction, the owner of the hunting lease must pay the individual farmer or the community for damage. The district forest ranger arbitrates damage claims.

Coordinated efforts are made to keep forest game damage under control. The procedure is somewhat as follows: The landowners meet annually with the district forest ranger and discuss problems of forest damage. If landowners decide that game damage is too high for best tree reprdduction they recommend an increase in kill to the Province Game Department who must effect any reductions.

Insect Damage.--Several insects cause some forest damage to spruce-fir-larch forests. Dreyfusei nusslini, introduced from the Orient, attacks foliage of fir. It is controlled by applying a chemical to the base of a tree; when the chemical is burned, the smoke kills the insects. Chermes viridis initially attacks needles of cut spruce; from these breeding colonies it spreads to larch (Larix europea). Logs of spruce are attacked by the engraver beetle (Ips tipographus). Damage can be prevented by barking down logs.

Other Forest Damage.--Snow, ice and storm damage are rather severe in Austrian forests. Foresters estimate that 15 percent of the annual growth is lost to these causes.

The fir jay (Nucifraga) is a serious threat to cembra pine reproduction because of heavy depradation on seeds.

Damage by fire is relatively unimportant. Environmental conditions conducive to fires do not occur frequently. Moreover, a high density of human population in forests favors quick detection and suppression of fires--particularly those started by recreationists.

Less than one percent of the forest is burned annually. Most of the fires start during dry springs. The main causes of fires are trains, hikers and tourists. A 100-acre fire is a large fire. Rains and hand shovels are relied upon mainly for control.

SILVICULTURE

The silviculture method used at lower elevations in spruce-fir-larch forests is known as the "hole-cutting" method. Small trees are cut first to form a small hole in the canopy. Fir reproduces first; then spruce is established beneath the fir. In successive cuts, the size of the hole in the canopy is gradually increased. Eventually, "holes" are developed widespread over the entire forest. In addition to encouraging reproduction, this type of cutting reduces windthrow losses. Slash is not removed after logging. In fact, piles of slash are important for reducing snow-blowing and bending over of small trees.

At the higher elevations in larch-spruce-fir forests the silviculture method known as "little place" cutting is used. Old trees are retained to protect reproduction. Clear-cuts are made in strips or squares to reduce damage from snow.

Silviculture for pine differs somewhat from that for the mixed forest. On north slopes, where there is a mixture of cembra pine and spruce the "little place" technique is used. On south slopes where the stand is mostly larch and spruce a few old larch are left as a modification of "little-place" cutting. If reproduction does not come in shortly, larch is planted in groups. There Pinus montana is the main species natural reproduction is difficult, but it is the only method giving satisfactory results.

There is much fuel-cutting in Tyrol forests. Farmers are permitted to cut any amount up to 10 m^3 for their own use. If an individual desires to cut more than this amount he must obtain permission from the Province Forest Service. The amount the individual can exceed 10 m^3 is up to the discretion of the forest supervisor. In general, about 95 percent of the fuel wood consists of conifers, and the remainder, hardwoods, with the most important species being Fagus sylvaticus and Acer platanoides.

Forest planting techniques are well developed in the Tyrol Province. On wet sites 60-70 percent Picea extensior (4 yrs. old), 20 percent Abies alba (5-6 yrs. old) and 10 percent Fagus silvticia (4-5 yrs. old nursery stock) are used. On dry sites a mixture of 2 yr. -old nursery stock of Pinus sylvatica and Larix europea is planted. Root pruning of nursery stock depends on the elevation of the planting. Stock is grown at sea level. The higher the elevation of the planting sites, the more roots of planting stock are pruned.

MANAGEMENT AND ADMINISTRATION

The district ranger prepares the plan of economy for his district. This plan includes timber and grazing plans for lands in both private and state ownership. In the Tyrol Province distribution of ownership is:

Private lands	
Less than 50 ha.	-34%
Over 50 ha.	- 3%
State lands	-22%
Community lands	-42%

Ths district ranger also advises farmers how to cut their timber and how to fence and graze their lands. The ranger will indicate to each farmer the amount to be cut, where the cuts should be made and how the logs are removed from the woods. The ranger also combines sales from several farmers so that a better price can be received on the market. Also, the ranger combines order for planting stock to reduce costs.

TIROLER JAGERVERBAND

Dr. Waldstein, Head of the Province Game Group, provided information of their activities. (His English was good enough to pose no problem of communication).

Among the 7 provinces in Austria each has its own laws for the regulation of game protection and kill. Ownership of game falls into three categories: (1) On state land the game is owned by the province. (2) On private lands, where an owner has more than 200 hectares, the game belongs to him. (3) If a land-owner has less than 200 hectares, game on his land is pooled into a community cooperative.

The Province regulates game kill on all lands. For game on lands in community ownership, hunting rights are leased to the Hunting Club for 9 years. Owners of game, whether, state, community or private are required to maintain game keepers. One gamekeeper is required for each 2000-3000 hectares.

Each hunter is a member of the Tiroler Jagerverband and is issued a license by officials of the organization. The Tyrol Club has about 6,000 members. Each hunter pays a membership fee.

The Province Hunter Club prepares examinations for both hunters and gamekeepers. Officials are university-trained people. Gamekeepers are not required to be university-trained.

Coordination of various activities on both state and private land is handled by the Counseil Internationale de La Chasse.

Hunter rewards come from the kind of trophy taken during the hunting season. Good trophies require animals of an age for each species as follows: chamois - 8 years +. red deer = 10 yrs. +, and roebuck - 5 yrs. +.

For each male taken a hunter is required to kill one female. After the hunting season a trophy contest is held. Judges make awards to individual hunters. A "green" award is made for a good trophy; a "red" award is given for a poor trophy.

ALPEN ZOO, INNSBRUCK

The Alpen Zoo is directed by Dr. Psenner. He speaks no English but his daughter did a creditable job of translating having studied English in High School.

The Alpine Zoo, with its Research Institute for Alpine fauna, is known widely through Europe. Enclosures are modern such as those for marmots, lynx, beaver and otter. There are also large runs for European bison, bears, chamois, and ibex.

The zoo is constructed in a natural setting highly reminiscent of the San Diego Zoo of California. Enclosures are of modern construction (Fig. 9). All of the species, with the exception of the American beaver, are or were native to the Alps. There were more than 25 species of birds and 13 species of mammals endemic to the Alps.8/

In addition to its natural setting, the zoo is unique in at least two other respects. Dr. Psenner has had phenomenal success in breeding animals in captivity. He has produced young among several wild species for the first time in the history of zoo management.

8/ See Appendix IV and V for a checklist of birds and mammals.

Secondly, Director Psenner has made great effort to collect and possibly disseminate some of the rare and endangered species. To mention a few: he had a pair of western buzzards; a pair of wildcats (Felix silvestris), yet to produce young; and a native otter (Lutra lutra); other species in the zoo, now extinct in the Alps included the baldheaded ibis, bearded vulture, and the wall creeper.

The zoo is financed from four different sources. The state and city both contribute financially. An admission charge makes up another portion. Major contributions come from private donations.

About 300 people are employed by the zoo at 50 different tasks. This is no small operation! It is considerable effort directed at a most worthy cause.

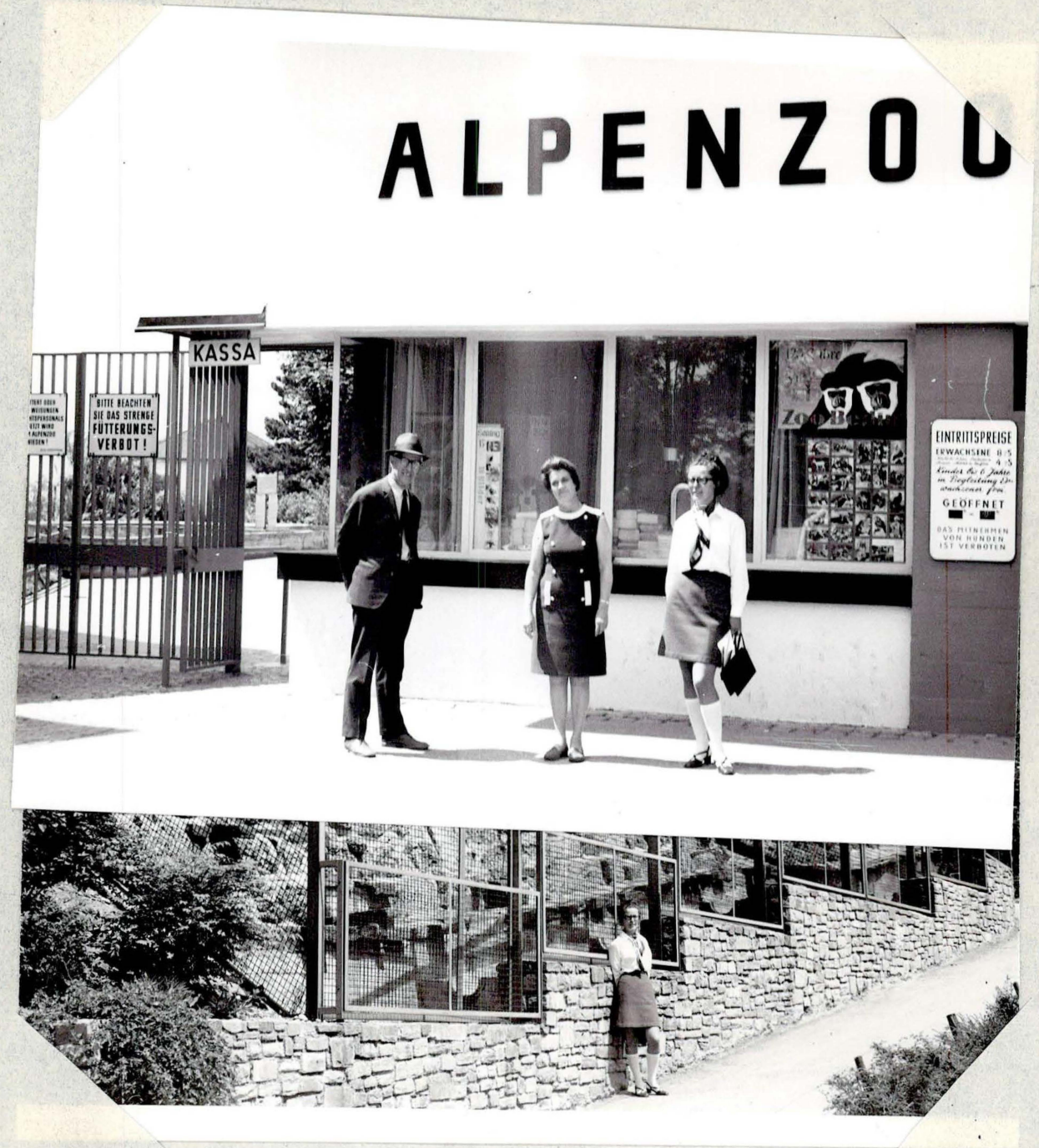

Figure 9.--Above - Entrance to the Alpen Zoo with Dr. Psenner, Mrs. Reynolds and Miss Psenner. Below - One of the modern enclosures used to exhibit mammals of the Alps.

CZECHOSLOVAKIA

ORGANIZATIONS

Game management in Czechoslovakia is handled by two different ministries: (1) The Ministry of Agriculture and (2) The Ministry of Forestry, Water and Pure Air. The Ministry of Agriculture contains the Department of Game Management, which handles legislation, regulates game numbers, and prepares examinations for membership in the Czechoslovakia Hunting Club. The Ministry of Forestry, Water and Pure Air contains the Department for Research and also manages the Hunting Preserves.

The Czech Hunting Club is a volunteer organization of some 135,000 members. Membership is earned by examination. Members must pass both a theoretical and practical examination. Moreover, they must have 2 years of apprentice hunting experience. Examinations cover such topics as zoology, use of the rifle, basic knowledge of hunting, and habits of game animals.

The Czechoslovakia Travel Agency is also concerned with hunting. They solicit and arrange for hunting by foreigners. This special provision for hunting is a financial arrangement that brings significant income into the country.

Education in Czechoslovakia begins with grade and proceeds to high school from which students graduate at the age of about 18 years. From high school qualified students, who wish to pursue forestry training, can attend one of 3 professional (university) schools or one of four administrative (training) schools. Within a professional forestry school there are 12 departments one of which is concerned with Game Keeping and Zoology.

In the Forestry Research Institute graduates from other departments, as well as Game Keeping, are employed. Present professional employment is: 1 veterinarian, 3 biological scientists, 1 chemist, 6 general scientists, and 10 graduate students.

Non-professionals work at two levels. At one level are part-time workers, who are not required to pass an examination, but who serve more-or-less as laborers in helping with game keeping and rearing.

A higher level of work can be attained by non-professionals. First, they must pass a general examination prepared by the State Legislature. After one year of practice and 6 months of training, individuals are then qualified to take a state examination as prepared by a committee in the University of Agriculture. The State Examinations are concerned with qualifications for the following subject-matter fields: Zoology of Deer, Care of Deer, Diseases of Deer, Shooting Ballistics, Dog Science, and Policy Making.

GAME MANAGEMENT

Problems.--Populations of roebuck and red deer in Czechoslovakia are so high as to exceed the carrying capacity of their environment. Fallow deer numbers are about in balance with the capacity of the environment. Mufflon are below numbers thought possible. Efforts are now being made to select areas of proper environment for dissemination and increase of this later species.

All hunting in Czechoslovakia is on Hunting Reservations of which there are thirty-four. Here propagation of fallow deer, red deer and mufflon are pursued on an intensive basis. On some reservations there are also small populations of Japanese deer and Canadian deer.

Habitat Requirements.--There has been considerable work on determining the habitat requirements of big game. Known habitat needs of some of the species are:

MUFFLON

Forage Class	Area (%)
Browse (shrubs)	50-60
Forbs (herbs)	
Grasses	15-20
Field Crops	10
Cover (Trees)	10

FALLOW DEER

Forage Class	Area (%)
Shrubs	40
Grasses	30
Field Crops	15
Cover (Trees)	15

RED DEER

Forage Class	Area (%)
Shrubs	70
Grasses	10
Field Crops	10
Cover (Trees)	10

Hunting Preserves.--Since several different species of deer may be propagated on a single reservation, and their requirements differ somewhat, a compromise is made with regard to vegetation management. In general, 67 percent of a reservation is maintained in trees and 33 percent is convered to grass. A sustained cover of trees is maintained by cutting sufficient area of 3 hectares in size periodically to maintain continuous productivity.

There is some competition among the various species of deer on a reservation. General competitive relations are: Fallow deer and mufflon live together well with a minimum of competition. Red deer compete seriously with both Japenese deer and fallow deer because of similarities in food habits.

There is some winter feeding of deer. Amount of feeding depends upon the severity of the particular winter. Supplements include hay, dried leaves of trees, silage and corn (for carbohydrates); in addition, potatoes and sugar beets are added to the diet, mainly for a water supplement.

The primary game management objectives on reservations are to:

(1) Maintain a 1:1 sex ratio.

(2) Achieve a balance between animal population and carrying capacity of the environment.

(3) Improve the nutritive quality of the forage.

N.B. This report is incomplete. A number of publications (in English) are yet to be briefed because they are still in transit. Moreover, there was insufficient time to gain a full appreciation of game management methods, techniques and problems in Czechoslovakia. Some idea of additional studies possibilities can be gained by the persual of an intinerary prepared by the Ministry of Agriculture (see Appendix III).

COMMENTARY

In some respects Austria and Czechoslovakia are ahead of American research in ecology; in other respects they are behind. Some impressions of research and suggestions as to how F.A.O. might assist with promoting research and development are given below.

1. There seems to be considerable opportunity for the interchange of research fellows between America and these countries. Some possibilities are:

   (a) The research on genetics in Austria should benefit greatly from visits by workers of this country to either or both: (1) the California Forest and Range Experiment Station and the Southern Experiment Station. These stations in America are advanced in experience, techniques and training in forest genetics.

   (b) Researchers in silviculture (physiology of trees) in Austria could benefit greatly from observing tree physiology studies at Duke University and the University of California, among other institutions in America.

(c) Workers on game nutrition and behavior in Czechoslovakia could benefit from visits to the Rocky Mountain Forest and Range Experiment Station and other institutions using advanced techniques, both in vitro and in vivo, for studying nutrition. Also, as another example, Czech workers are doing no telemetry work, which is well-advanced in America.

(d) Mutual benefit should accrue from an exchange of fellows between Austria and America with regard to "multiple use" of forests. Austria is well advanced in some phases of multiple use but could benefit from advances in recreation (a relatively new problem to Austria) in America.

(e) Exchange of fellows in forest damage might also prove beneficial e.g. America has a new project in the Pacific Northwest Forest and Range Experiment Station. Both Austria and Czechsolovakia have considerable experience in this area of research.

2. There seems to be little research in either Austria or Czechoslovakia on ecology of animals and plants as one complete unit. There still seems to be a tendency to separate plant and animal ecology. Some of the ecological work being done by the Atomic Energy Commission, computer simulation work in ecology by several universities, and the I.B.P. program should prove a stimulus to European workers.
3. The concept of rare and endangered species in both Europe and America is relatively new. An exchange of philosophies might benefit both.
4. F.A.O. might consider sponsoring demonstration areas in various European countries where most advanced ecological practices are practiced on the ground. The Tiergarten is an excellent example of what can be accomplished by application of ecological information to game-habitat management problems.

(5) Several research institutions in Europe do not have advanced technical and scientific equipment for doing research work. F.A.O. might survey the instrumentation developments in America and place some of this sophisticated equipment with Research Institutes and Universities to enhance research and teaching possibilities.

(6) Much ecological research information exists in German, French, Czech, Polish and Russian publications that is not available to American workers. Also, there may even be some breakdown in interchange of information among European countries. F.A.O. might consider development of an abstracting and translating service for world-wide distribution. Something comparable to Forestry Abstracts in England, and Wildlife Abstracts and Ecological Abstracts in America might serve as models.

APPENDIX I

Personal Background

(Hudson G. Reynolds)

EDUCATION: University of California at Berkeley, BS - Forestry; MS - Botany; Ph.D - Zoology (wildlife management).

EXPERIENCE: Teaching - 5 years, Univ. Arizona, Tucson (botany and forestry); Univ. California, Berkeley (forestry). Research - 21 years, Forest and Range Experiment Stations, U.S. Forest Service (reseeding; woody plant control; management of watershed, livestock grazing and wildlife habitat).

RESEARCH CONTRIBUTION: Locality - Arid lands of Southwestern United States. Grazing lands - reseeding, drought effects, woody plant control, livestock management. Watersheds - management and improvement. Wildlife - life history and ecology of Lepus, Dipodomys, and Perognathus; habitat relations of vertebrates; impacts of logging and livestock grazing on wildlife; habitat improvement for Cervus, Odocoileus and Meleagris.

MAJOR INTERESTS: Ecological research and management applications for ungulates, birds and rodents.

LANGUAGE FACILITY: (other than English) Poor reading knowledge of French, German and Spanish.

APPENDIX II

WILDLIFE STUDY OUTLINE

(Suggested by T. Riney)

Administration

- Dept. Responsibilities
- Educational Requirements

Management

- Plant Problems
  - Forestry
  - Agriculture
    - Kinds of Farming
    - Pesticides
- Animal Problems
  - Large Mammals
  - Fur Bearers
  - Upland Game
  - Water Fowl
  - Non-game Animals

Research

- Institutes
- Foundations

Education

University

Technical Schools

In-Service

Policy (ownership, etc.)

Private

Public

Legislation

Public Relations

Extension

F. A. O. Assistance

What

Where

How

APPENDIX III

STUDY OUTLINE FOR CZECHOSLOVAKIA

Information projects in the Department of Game Biology and Rearing:

I. Biology of partridge and pheasant. Population dynamics and reproduction of partridge and pheasant. Food requirements, investigations into usefulness and harmfulness of both species. Marking of small game and tracing of game in terrain.

II. Partridge rearing. Farm and hand rearing of partridge. Evaluation of various techniques of rearing. Survival of reared partridges after release, influence of climate and other factors, investigation into reproduction abilities in next season, influence of penning on the development of gonads at the partridge.

III. Biology of rearing of hare. Population dynamics of hare, based on the anatomic-histologic investigation of genitals of hare. Season biometrics of organs, osteological studies. Hunting methods and regulation of hare stands. Care for hare in the time of unsufficient food supply.

IV. Influence of pesticides on game. Investigation into toxic effects of pesticides used in agriculture and forestry in Czechoslovakia on game. Reduction of harms done by pesticides.

V. Ataractics, narcotics, sedativs and game: Use of chemical for tranquilization of game at the rearing, or at the vermin control.

VI. Intensive rearing of fallow deer in game preserves: Investigation into various methods of rearing game in game preserves, care for game, equipments for rearing, counting of game etc.

Excursion

1. Visit to Hunting Management Area Konopiste
2. Forest Enterprise Nymburk, game preserves Jabkenice and Vlkova (rearing of fallow deer, of mouflons)
3. Forest Enterprise Ronov, game preserve Zehusice (rearing of white Cervus elaphus)
4. Visit of game preserve Brezka (demonstration of illustrative development of fallow deer antlers)

Information on projects in the Department of Game Biology and Rearing:

VII. Basic processes of nutrition physiology of ungulates, digestibility time of individual nutrients etc.

VIII. Protection of forest and agricultural crops against damage done by game.

IX. Parasitic fauna of ruminants living in open areas.

X. Parasites of bird game and other small game.

XI. Relationships of parasites of ruminants living in open areas and of domestic animals.

XII. Prevention for control of parasites of ungulates-gourd worms.

Excursion

1. Forest Entreprise Hluboka, game preserve Ponesice and Stara obora (Old Preserve). (rearing of red deer, fallow deer, mouflons, wildboar, visit to Hluboka Castle and to the Hunting Museum Obora).

Information on projects in the Department of Game Biology and Rearing:

XIII. Season dynamics of main species of helminths of ungulates.

XVI. Experimental healing of synagamosis.

XV. Experimental healing of endoparasites of ungulates.

XVI. Prevention of diseases occurring at large scale rearing of pheasants.

XVII. Introduction of Fascioloides magna to Europe.

XVIII. Intensive rearing of pheasants. Farm rearing, rearing methods, return, reproduction.

Rearing of pheasant in pheasantries. - management of forests and hunting grounds.

Food for pheasants.

Hand rearing of ducks.

Problems of prospects for intensive rearing of pheasants in the United States, regions for breeding, environment conditions, planning of hunting, release of game etc.

Problems of natural nutrition of ungulates, classification of carrying capacity, damage due to game.

APPENDIX IV

CHECK LIST OF BIRDS

SCIENTIFIC NAME	COMMON NAME	LOCALITY		
ACCIPITRIDAE				
Aquila	Golden Eagle		**	
Bueto lagopus	Rough-legged Buzzard		**	
Gypaetus barbatus	Bearded Vulture (now reintroduced but no nesting success yet).		**	
Pernis apivorus	Honey Buzzard		**	
ABATUDAE				
Anas platyrhynchos	Mallard		**	
APODIDAE				
Apus apus	Swift	*		
ARDEIDAE				
Bubulcus ibis	Cattle Egret			***
Egretta alba	Snowy Egret	*		***
Ardea purpurea	Purple Heron			***
CICONIIDAE				
Ciconia ciconia	White Stork			***
Ciconia nigra	Black Stork		**	
COLUMBIDAE				
Streptopelia decaocto	Collard Turtle Dove			***

SCIENTIFIC NAME	COMMON NAME	LOCALITY		
CORVIDAE				
Corvus corax	Raven		**	
Corvus corone cornix	Hooded Crow	*		
Corvus monedula	Jack Daw			***
Nucifraga caryocatactes	Nutcracker		**	
Pyrrhocorax graculus	Alpine Chough		**	
FALCONIDAE				
Falco subeto	Hobby Falcon		**	
Falco tinnunculus	Kestrel		**	
Falco vespertinus	Red-footed Falcon		**	
FRINGILLIDAE				
Fringilla coelebs	Chaffinch	*		
HIRUNINIDAE				
Males males	Beech Martin		**	
MEROPIDAE				
Meropos apiaster	Bee Eater			***
MOTACILLIDAE				
Motacilla alba	Pied Wagtail	*		
OTIDIDAE				
Otis tarda	Great Bustard	*		***

SCIENTIFIC NAME	COMMON NAME	LOCALITY		
PARIDAE				
Parus ater	Coal Tit	*		
Parus cristatus	Crested Tit	*		
Parus lugubris	Sombre Tit	*		
Parus major	Great Tit			***
PHASIANIDAE				
Aletoris chukar	Chukar		**	
PHOENICOPTERIDAE				
Phoenicopterus ruber	Flamingo			***
PICIDAE				
Dendrocopos medius	Middle-spotted Woodpecker	*		
PLATALEIDAE				
Geronticus eremita	Bald Ibis		**	
POLCEIDAE				
Passer montanus	Tree Sparrow	*		***
RALLIDAE				
Gallinula chloropus	Moorhen		**	
SCOLOPACIDAE				
Philomachus pugnax	Ruff		**	
Numenium arquata	Curlew		**	
SITTIDAE				
Sitta europaea	Nuthatch	*		***
Tichodroma muraria	Wall Creeper		**	

SCIENTIFIC NAME	COMMON NAME	LOCATION		
STRINGIDAE				
Aegolius funereus	Tengmalm's Owl	**		
Asio otus	Long-eared Owl	**		
Bubo bubo	Eagle Owl	**		
Cryptoglaux funerea richardsoni	Richardson's Owl		***	
Glaucidium passerinum	Pygmy Owl	**		****
Otus scops	Scops Owl	**		
Strix aluco	Tawny Owl	**		
STURNIDAE				
Montifringilla nivalis	Snow Finch	**		
Sturnus roseus	Rose-coloured Starling	*		
Sturnus vulgaris	Starling	*		
TETRAONIDAE				
Lagopus mutus	Ptarmigan	**		
Lyrurus tetrix	Black Grouse		***	
Tetrao urogallus	Capercaillie	**	***	
TURDIDAE				
Turdis merula	Blackbird	*		

* Forest Institute

** Alpen Zoo

*** Biological Station

**** Tiergarten

APPENDIX V

CHECK LIST OF MAMMALS

SCIENTIFIC NAME	COMMON NAME	LOCALITY	
BOVIDAE			
Bison bonases	European Bison	**	
Bos	Auroch		****
Raphicerus	Steinbok	**	
Rupicapra rupicapra	Chamois	**	
CANIDAE			
Canis lupus	Wolf	**	
Vulpes	Red Fox	**	
CERVIDAE			
Capreolus	Roedeer		****
Cervus	Red Deer	**	****
Dama dama	Fallow Deer		****
EQUIDAE			
Equus	Wild Horse		****
FELIDAE			
Felix lynx lynx	Lynx	**	
Felis sylvestris	Wildcat	Found in forest	
MUSTELIDAE			
Lutra lutra	Otter	**	
Meles meles	Badger	**	

SCIENTIFIC NAME	COMMON NAME	LOCALITY
SCIURIDAE		
Marmota marmota	Alpine Marmot	**
Sciurus	Tree Squirrel	*
SUIDAE		
Sus	Swine	****
URSIDAE		
Ursus	Black Bear	**

* Forest Institute

** Alpen Zoo

*** Botanical Station

**** Tiergarten

APPENDIX VI

CHECK LIST OF TREES

(DESERT BOTANICAL GARDENS)

INNSBRUCK, AUSTRIA

SCIENTIFIC NAME	COMMON NAME
ACERACEAE	
Acer campestre	Common Maple
Acer platanoides	Norway Maple
Acer saccharum	Sugar Maple
BETULACEAE	
Carpinus betulus	Common Hornbeam
CONIFERAE	
Thuja occidentalis	Arbor-vitae
HAMMELIDACEAE	
Parrotia persica	C. A. Meyer
JUGLANDACEAE	
Juglans regia	Common Walnut
Peterocarya fraxinifolia	Caucasian Wing-Nut
LEGUMINOSAE	
Cladrastis lutea	Yellowwood
OLEACEAE	
Fraxinus coriariaefolia	Velvet Ash
Fraxinus parvifolia	Small-leaved Ash

SCIENTIFIC NAME	COMMON NAME
PLANTANACEAE	
Plantanus acerifolia	London Plane
ROSACEAE	
Crataegus lavalles	Hawthorne
Crataegus monogyna	One-Seed Hawthorne
Mespilus germanica	Medlar
Prunus incana	Willow Cherry
Pyrus malus	Pear
Rhamnus cathartica	Common Buckthorn
RUTACEAE	
Ptelea trifoliata	Common Hoptree
SALICACEAE	
Salix fragilis	Crack Willow
SAPENDACEAE	
Aesculus hippocastanum	Horse-chestnut

APPENDIX VII

ADDRESSES OF CONTACTS

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